WHAT IS CLAIMED IS:

1. A multi-wavelength optical packet switch system with shared output buffer, comprising:

N input fibers and N output fibers, each fiber being able to transmit an M-wavelength optical signal, which has M wavelength, where N, M are positive integers;

an input device, connected to the N input fibers to separate the M-wavelength optical signal in each input fiber into M input optical signals corresponding to the M wavelengths;

a wavelength converter, connected to the input device to tune wavelengths of the input optical signals;

a wavelength router, connected to the wavelength converter to switch packets of each optical signal outputted by the wavelength converter;

an output buffer, connected to the wavelength router to provide output optical packets of the wavelength router with time delay from 0 to L packet frames;

a wavelength classifier, connected to the output buffer to tune wavelengths for the output optical packets to wavelengths of the corresponding output fibers; and

a control device, connected to the wavelength converter to read packet headers of the input optical signals to accordingly analyze output fiber fields of all packet headers, thus obtaining corresponding output fibers and output conflicts for adjusting the wavelength converter and

subsequently completing packet switching performed by the wavelength router.

2. The system as claimed in claim 1, wherein the input device consists of N optical demultiplexers, each having an input terminal and M output terminals, the input terminal being connected to one of the input fibers for separating the M-wavelength optical signal in the input fiber into M input optical signals corresponding to the M wavelengths and thus the M output terminals outputting the M input optical signals respectively.

3. The system as claimed in claim 1, wherein the wavelength converter consists of NxM tunable wavelength converters, ((I-1)xM)-th to (IxM-1)-th tunable wavelength converters connected respectively to M output terminals of I-th optical demultiplexer, where N, M, I are positive integers.

4. The system as claimed in claim 3, wherein the control device is based on following equation to set converted wavelengths of the tunable wavelength converters:

$$W_{ijkl} = (NM - iM - j + k(L+1) + l) \bmod (NM),$$

where N is fiber number, M is transmittable wavelength number in one fiber, L is the maximum number of packet frames for time delay, i is serial number of input fiber for input packets, j is serial number of input wavelength for input packets, k is the number of packet frames required by input packets for time delay, l is serial number of output fiber for output packets, and W_{ijkl} is serial number of converted wavelength of (i, j)-th tunable wavelength converter.

5. The system as claimed in claim 4, wherein the wavelength router is an arrayed waveguide grating having NxM input terminals and (L+1)xN output terminals for switching packets of the optical signals of the wavelength converter, where N, M, L are positive integers.

6. The system as claimed in claim 5, wherein the output buffer consists of N delay devices, each delay device having (L+1) optical delay elements numbered from 0 to L and number p optical delay element providing time delay with p packet frames, where N, L, p are positive integers.

7. The system as claimed in claim 6, wherein input terminals of (L+1)xN optical delay elements of the output buffer are connected respectively to (L+1)xN output terminals of the wavelength router based on the following equation:

$$OB_{ab} = a + bN \text{ ,}$$

where N is total output fiber number, a is serial number of output fiber, b is serial number of optical delay element, and OB_{ab} is serial number of output port of the wavelength router.

8. The system as claimed in claim 7, wherein the (L+1)xN optical delay elements are optical fiber delay lines.

9. The system as claimed in claim 1, wherein the wavelength classifier consists of N wavelength classifying elements respectively coupled between the N delay devices of the output buffer and the N output fibers, each of the wavelength classifying elements further including:

an optical coupler having (L+1) input terminals and an output

terminal, such that the (L+1) input terminals are connected respectively to the (L+1) optical delay elements for optically coupling signals of the (L+1) optical delay elements, and the output terminal outputs a resulting optical signal optically coupled;

a modulus optical demultiplexer having an input terminal and M output terminals, such that the input terminal is connected to the output terminal of the optical coupler for separating the resulting optical signal into M optical signals respectively with a different wavelength, and the M output terminals output the M optical signals respectively;

M fixed wavelength converters, each having an input terminal and an output terminal, such that the input terminal is connected to one of the M output terminals of the demultiplexer for converting packets of output optical signals of the demultiplexer into an assigned wavelength for output by the output terminal; and

an optical multiplexer having M input terminals and an output terminal, such that the M input terminals are connected respectively to the output of each of the converters for merging output optical signals with wavelengths and accordingly the output terminal outputs a resulting signal with the wavelengths to one of the N output fibers.

10. The system as claimed in claim 9, wherein the modulus optical demultiplexer is a 1xN arrayed waveguide grating.

11. A multi-wavelength optical packet switch system with shared output buffer, comprising:

N input fibers and N output fibers, each fiber being able to transmit

an M-wavelength optical signal, which has M wavelength, where N, M are positive integers;

an input device, connected to the N input fibers to separate the M-wavelength optical signal in each input fiber into M input optical signals corresponding to the M wavelengths;

a first wavelength converter, connected to the input device to tune wavelengths of the input optical signals;

a first wavelength router, connected to the first wavelength converter to switch packets of the input optical signals for averagely dispatching the packets to available wavelengths;

a second wavelength converter, connected to the first wavelength router to tune wavelength of each optical signal outputted by the first wavelength router;

a second wavelength router, connected to the second wavelength converter to switch packets of each optical signal outputted by the second wavelength converter;

an output buffer, connected to the second wavelength router to provide output optical packets of the wavelength router with time delay from 0 to L packet frames;

a wavelength classifier, connected to the output buffer to tune wavelengths for the output optical packets to wavelengths of the corresponding output fibers; and

a control device, connected to the first and second wavelength converters to read packet headers of the input optical signals to accordingly

analyze output fiber fields of all packet headers, thus obtaining output fibers and corresponding output conflicts for adjusting the first wavelength converter, setting the second wavelength converter, and subsequently completing packet switching of the optical signals by the wavelength router.

12. The system as claimed in claim 11, wherein the input device consists of N optical demultiplexers, each having an input terminal and M output terminals, the input terminal being connected to one of the input fibers for separating the M-wavelength optical signal in the one input fiber into M input optical signals corresponding to the M wavelengths and thus the M output terminals outputting the M input optical signals respectively.

13. The system as claimed in claim 11, wherein the first wavelength converter consists of NxM tunable wavelength converters, ((I-1)xM)-th to (IxM-1)-th tunable wavelength converters being connected respectively to M output terminals of I-th optical demultiplexer, where N, M, I are positive integers.

14. The system as claimed in claim 13, wherein the control device is based on following equation to set converted wavelengths of the tunable wavelength converters of the first wavelength converter:

$$W_{ijkl}^{1} = i \times M + j\,,$$

where M is transmittable wavelength number in a fiber, i is serial number of input fiber for input packets, j is serial number of output wavelength for packet, and W_{ij}^{1} is serial number of converted wavelength of (i, j)-th

tunable wavelength converter.

15. The system as claimed in claim 14, wherein the first wavelength router is an arrayed waveguide grating having NxM input terminals and NxM output terminals for switching packets of optical signals of the first wavelength converter, where N, M, L are positive integers.

16. The system as claimed in claim 15, wherein the second wavelength converter consists of NxM tunable wavelength converters to tune wavelength of each optical signal outputted by the first wavelength router.

17. The system as claimed in claim 16, wherein the control device is based on following equation to set converted wavelengths of the tunable wavelength converters of the second wavelength converter:

$$W_{ijkl}^{2} = (NM - iM - j + k(L+1) + l) \bmod (NM),$$

where N is fiber number, M is transmittable wavelength number in one fiber, L is the maximum number of packet frames for time delay, i is serial number of input fiber for input packets, j is serial number of input wavelength for input packets, k is the number of packet frames required by input packets for time delay, l is serial number of output fiber for output packets, and W_{ijkl}^{2} is serial number of converted wavelength of (i, j)-th tunable wavelength converter.

18. The system as claimed in claim 11, wherein the second wavelength router is an arrayed waveguide grating having NxM input terminals and (L+1)xN output terminals for switching packets of optical

signals of the second wavelength converter, where N, M, L are positive integers.

19. The system as claimed in claim 18, wherein the output buffer consists of N delay devices, each delay device having (L+1) optical delay elements numbered 0 to L and number p optical delay element providing time delay with p packet frames, where N, L, p are positive integers.

20. The system as claimed in claim 19, wherein input terminals of (L+1)xN optical delay elements of the output buffer are connected respectively to (L+1)xN output terminals of the second wavelength router based on the following equation:

$$OB_{ab} = a + bN,$$

where N is total output fiber number, a is serial number of output fiber, b is serial number of optical delay element, and OB_{ab} is serial number of output port of the wavelength router.

21. The system as claimed in claim 20, wherein the (L+1)xN optical delay elements are optical fiber delay lines.

22. The system as claimed in claim 11, wherein the wavelength classifier consists of N wavelength classifying elements respectively coupled between the N delay devices of the output buffer and the N output fibers, each of the wavelength classifying elements further including:

an optical coupler having (L+1) input terminals and an output terminal, such that the (L+1) input terminals are connected respectively to the (L+1) optical delay elements for optically coupling signals of the (L+1) optical delay elements and the output terminal outputs a resulting optically

coupled optical signal;

a modulus optical demultiplexer having an input terminal and M output terminals, such that the input terminal is connected to the output terminal of the optical coupler for separating the resulting optical signal into M optical signals respectively with a different wavelength and the M output terminals output the M optical signals respectively;

M fixed wavelength converters, each having an input terminal and an output terminal, such that the input terminal is connected to one of the M output terminals of the demultiplexer for converting packets of output optical signals of the demultiplexer into an assigned wavelength for output by the output terminal; and

an optical multiplexer having M input terminals and an output terminal, such that the M input terminals are connected respectively to the output of each of the converters for merging output optical signals with wavelengths and accordingly the output terminal outputs a resulting signal with the wavelengths to one of the N output fibers.

23. The system as claimed in claim 22, wherein the modulus optical demultiplexer is a 1xN arrayed waveguide grating.